



Optimal Monetary Policy with Inflation, Output and Asset Price Volatility in an Open Economy

Peter Wamalwa

November 2023 / No.818

Abstract

This paper aims to establish optimal response of monetary policy to output, inflation, and asset price volatility in small open economies of Kenya and Ghana. The paper estimates a monetary policy response function for inflation, asset prices, and output volatility developed from a dynamic stochastic general equilibrium model using quarterly data from 2000 to 2018. The analysis shows that monetary policy accord inflation greatest weight compared to output and asset prices. However, there are differences in the sensitivity of monetary policy across the economies, and hence price, output, and welfare outcomes. The

prioritization of inflation stifles output growth more in Ghana than in Kenya due to high interest rate. Despite monetary policy prioritizing inflation in Ghana, average inflation is higher compared to Kenya. Results from dynamic optimization show that a consistent intervention in the economy to stabilize inflation, output, nominal exchange rate, and asset prices, achieves higher welfare.

Introduction

Monetary authorities in developing economies desire to hasten economic growth and maintain price stability simultaneously. Interest rates are employed to regulate prices, which in turn influence the level of utilization of the economy's resources and the size of output gap. However, on the one hand, elevated interest rate geared towards maintaining price stability stifles growth (Woodford, 2003; Divino, 2009). On the other hand, extended periods of stable inflation and robust growth precipitate asset price misalignment. Furthermore, a small open economy is exposed to external shocks that affect nominal exchange rate stability. The movements in the nominal exchange rate affect inflation, hence requires monetary policy intervention. Yet, intervention in the foreign exchange market may be inconsistent with the output gap and inflation target (Clarida *et al.*, 2001; Corsetti & Pesenti, 2005).

The competing monetary policy objectives have reignited the debate on the effectiveness and optimality of monetary policy actions. Despite the raging debate, monetary policy operational frameworks and empirical studies have focused more on the effectiveness of monetary policy against price and output instability (for example, Kobayashi, 2004; Kholodilin *et al.*, 2009; Koop *et al.*, 2009; Misati *et al.*, 2011; Misati & Nyamongo, 2012a). Yet, optimality of monetary policy stabilization actions is equally important in contemporary economies experiencing output and price shocks.

Therefore, this paper analyses optimal monetary policy stabilization of inflation, output, and asset prices in small open economies of Kenya and Ghana. The paper focuses on Ghana and Kenya because the economies have a developed financial sector and exhibit significant international portfolio flows, but they have different monetary policy frameworks. This enables the analysis of stabilization issue in open economies with comparable level of development and openness, but under different monetary policy frameworks. In particular, the paper first establishes weights employed by monetary policy in response to inflation, output, and asset price volatility. The paper then evaluates optimality of the monetary policy response using a welfare criterion as in Divino (2009).

Hence, the paper develops a monetary policy reaction and social welfare functions incorporating volatility based on a dynamic stochastic general equilibrium (DSGE) model. The parameters of monetary policy reaction function are estimated using

quarterly data from 2000 to 2018 for Kenya and Ghana. Other parameters of the model are calibrated to reflect characteristics of Kenyan and Ghanaian economies. The social welfare function is solved numerically using the dynamic programming method of Bellman and Lee (1984), considering optimization decisions of households and firms; an approach that has been emphasized and used by Rotemberg and Woodford (1997), Benigno (2004), and Divino (2009) in their analysis of optimal monetary policy. The formulation and numerical solution of the social welfare problem as a dynamic programme enables estimation of the time path of monetary policy rate that maximizes social welfare. The path for optimal monetary policy rate incorporates static and dynamic responses of agents to monetary policy actions in an economy. The welfare, output, and price are then evaluated under discretion and consistency rules in the two economies.

The parameter estimates of the monetary policy reaction function indicate that inflation is accorded the strongest response of 1.48 and 1.41 compared to output of 0.25 and 0.12 for Kenya and Ghana, respectively. This is consistent with the stated monetary policy objective of stabilizing prices to enhance growth in the two economies. Bond yields are stabilized by employing weights of 0.35 and 0.26, while equity prices have weights of 0.16 and 0.14 for Kenya and Ghana, respectively. The yields on bonds are stabilized with greater weight compared to equity prices. Stability of yields on bonds enable investors, especially financial institutions, to allocate credit and better manage liquidity through holding liquid debt instruments in response to monetary policy action. This enhances the effectiveness of yields in transmitting monetary policy stimulus to the real sector via changes in asset prices. The responsiveness of monetary policy to equity and yields is greater for Kenya compared to Ghana. This is due to differences in the depth of the capital market in Kenya and Ghana, as well as strength of the pass-through of monetary policy stimulus to the real sector via changes in interest rate. Deeper capital markets are responsive to monetary policy and have a significant impact on the real sector. Consequently, monetary policy can target asset prices to stabilize price and output. These results are qualitatively consistent with estimates of Were (2014) and Bleaney *et al.* (2019) with respect to the response of monetary policy to inflation and output in Kenya and Ghana, respectively. The dynamic optimization results indicate that there are welfare gains when monetary authorities in Kenya and Ghana respond to inflation, output, and asset price instability consistently.

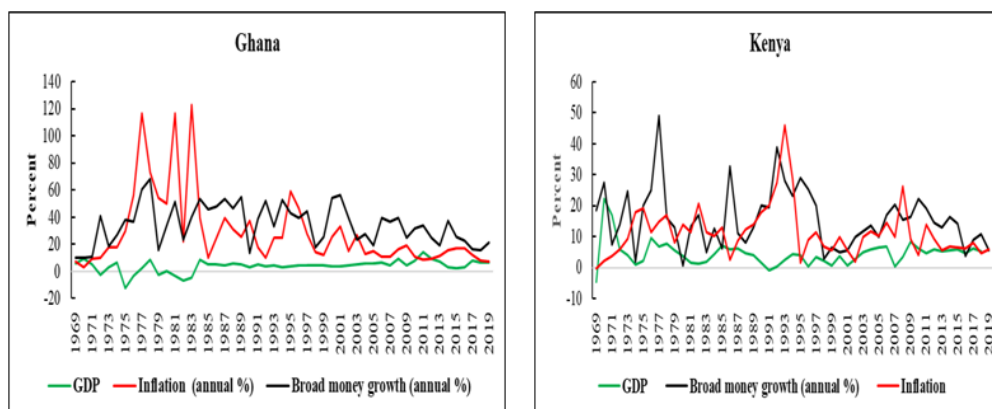
This paper, by estimating a reaction function and evaluating optimality of monetary policy action, makes the following contributions. First, the general equilibrium framework is able to capture the preferences of agents, as well as their responses to monetary policy. This provides a better estimate of the sensitivity of monetary policy on the target variable. Secondly, the paper employs numerical methods to establish optimal response of monetary authority when asset prices,

inflation, and output stability are in the monetary policy's objective function. Stability in prices and output encourages investment and economic growth in developing economies like that of Ghana and Kenya. Thirdly, the study enriches the debate on stabilization problems faced by monetary authorities in small open developing economies, in which available tools are fewer than objectives to be achieved. More importantly, the paper brings to light the stabilization outcomes in inflation targeting and in an economy transitioning to inflation targeting, an issue that has not received much attention. Fourth, the social welfare criterion for evaluating optimal monetary response is solved numerically using dynamic programming method. This method enables evaluation of social welfare outcomes resulting from monetary policy intervention to stabilize output, asset prices, and inflation under different regimes.

Monetary policy in Kenya and Ghana

Monetary policy in Kenya and Ghana, like other developing countries, is mainly used to stabilize price, which is essential for encouraging investment and output growth. Besides price stability, monetary policy is also employed to mitigate output fluctuations. The evolution of monetary policy in the two countries has been shaped by economic reforms intended to hasten economic growth. Notably, liberalization and removal of price controls, between 1985 and 1995, necessitated prioritization of price stability over output growth in the implementation of monetary policy. This is because liberalization and price decontrol led to increase in inflation, which undermined output growth. The emphasis on price stability objective achieved low and stable inflation, but at the expense of slow output growth rate between 1990 and 2001, whereby Kenya had a lower average growth of 2.1% compared to 4.1% for Ghana (see Figure 1).

Figure 1: Output, inflation, and monetary policy



Source: Illustration using data from Kenya National Bureau of Statistics and Ghana Statistical Service.

The monetary policy framework in Ghana and Kenya started with money targeting, whereby monetary authorities changed money supply in tandem with growth in nominal output. This ensures that there is just enough liquidity to finance transactions in the economy (McCallum, 1999). This explains the tendency for broad money to grow in tandem with inflation. The higher correlation between the growth rates of broad money and inflation in Kenya than in Ghana suggests that money targeting was more effective in controlling inflation in Kenya than in Ghana.

However, Ghana has transitioned fully to inflation targeting while Kenya is transitioning to inflation targeting. With respect to Ghana, monetary policy rate is adjusted following a Taylor rule in response to inflation stability. In addition, the monetary policy actions are geared towards influencing market interest rates and asset prices (Woodford, 2001; Kovanen, 2011; Bleaney *et al.*, 2019). Monetary policy operations in Kenya are similar to those of Ghana in so far as they are market orientated. The difference is that, whereas monetary policy rate in Kenya is adjusted gradually towards the target rate in order to achieve inflation and output targets, the policy rate adjustment in Ghana is greater than the deviation of inflation from the target (Bleaney *et al.*, 2019). The gradual adjustment of the policy rate to the desired target informs the financial market of the expected direction of monetary policy stance. This reduces uncertainty and builds inertia in the change in market interest rates, which enables economic agents to insure themselves against liquidity changes (Woodford, 2003, 2013).

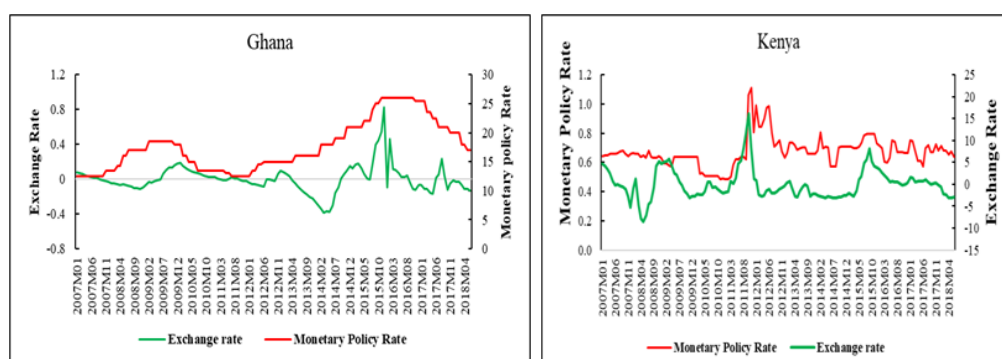
The monetary policy reaction function in Ghana reduces uncertainty because the interest rate rule informs expectations of the public about the reaction of monetary policy to inflation. However, the aggressive reaction to inflation leads to quick adjustment of market interest rates, which may precipitate liquidity distress to agents who cannot adjust their liquidity immediately. In addition, frequent changes in interest rates in response to inflation movements impede liquidity prediction, which reduces investment (Stulz, 1986; Wurgler, 2000). Yet, monetary policy in developing economies ought to encourage investment so as to realize economic growth and welfare improvement.

Another difference is that monetary policy in Ghana is precluded from responding to economic slowdown. This is because price stability objective supersedes output stability in the monetary policy reaction function. With respect to Kenya, movements in broad money are countercyclical to output growth rate, implying that monetary policy can be used to stabilize output (Vegh & Vuletin, 2012). Nevertheless, average output growth in Kenya is lower than in Ghana, but inflation is higher in Ghana compared to Kenya from 2000 to 2016 (Figure 1).

The level of openness of the economy and ease of portfolio flows through the capital market influence exchange rate movement. Significant movements in exchange rate disrupt allocation of liquidity and accentuate instability in the financial sector, which

undermine investment and growth. This has informed Bank of Ghana and Central Bank of Kenya's intervention in the foreign exchange market to mitigate volatility in exchange rate. The changes in monetary policy rate in Ghana affect nominal exchange rate with a lag. In some periods, for example between 2013 and 2014, whereas monetary policy rate increased gradually, exchange rate fluctuated in a wider range. In addition, volatility in exchange rate increased in 2015 and 2016, suggesting that volatility in exchange rate increased despite an increase in monetary policy rate to stabilize exchange rate. The increase in exchange rate volatility may have been influenced more by commodity price shocks, especially cocoa. The ineffectiveness of monetary policy in stabilizing exchange rate is also exacerbated by shallow financial market that inhibited transmission of monetary policy stimulus to real sector via changes in asset prices (Kovanen, 2011).

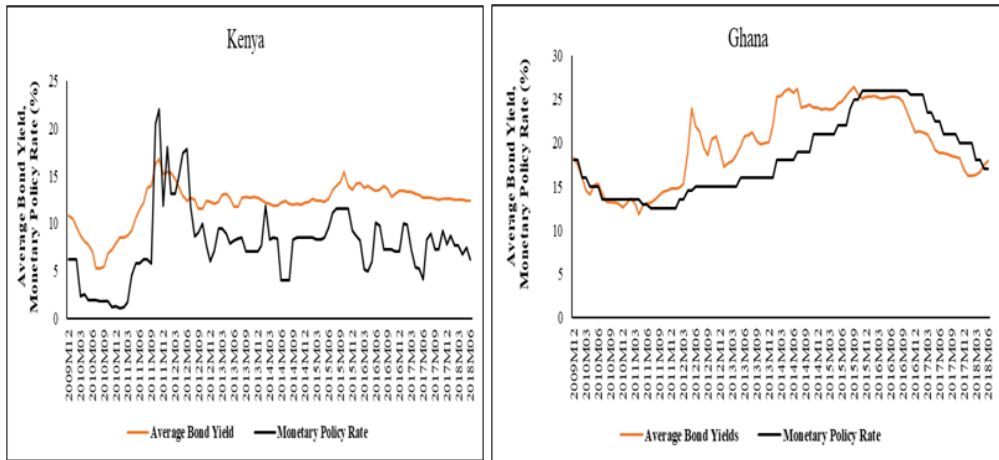
Figure 2: Effectiveness of monetary policy in mitigating exchange rate volatility



Source: Illustration using data from Kenya National Bureau of Statistics and Ghana Statistical Service.

Monetary policy rate in Kenya was not effective in mitigating volatility in exchange rate between 2007 and 2010. Global financial crisis, as well political instability, may have undermined stabilization effort of monetary authority. However, monetary policy was effective in stabilizing exchange rate between 2011 and 2018, as indicated by the deviation of exchange rate from its trend and being in concert with changes in monetary policy rate. The effectiveness of monetary policy in reducing volatility in exchange rate can be attributed to deeper financial market, which increases the responsiveness of exchange rate to liquidity changes induced by the Central Bank of Kenya.

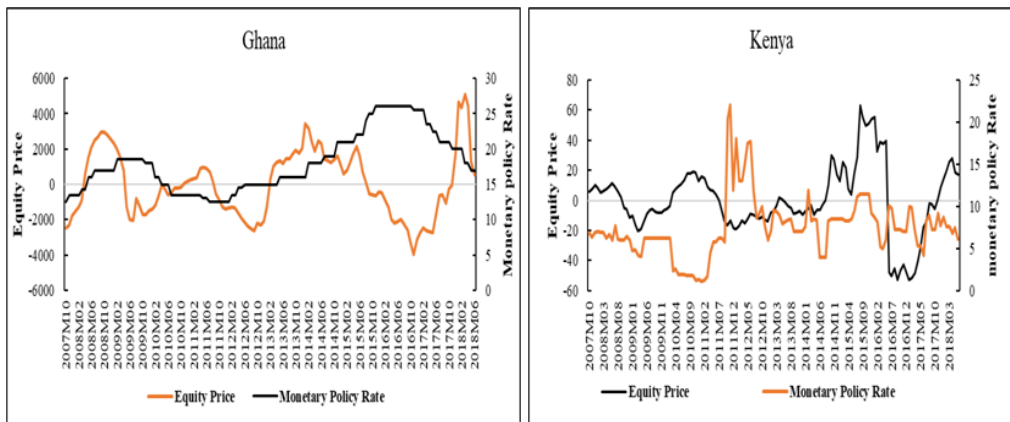
A deep financial market is efficient in transmitting monetary policy stimulus to the real sector. Hence, the responsiveness of yields and equity prices to monetary policy rate influence effectiveness of monetary policy. The yields on Ghanaian bonds change in tandem with monetary policy rate. However, yields on bonds traded on Nairobi Securities Exchange (NSE) in Kenya tend to deviate from monetary policy rate and their fluctuations weakly mimic changes in monetary policy rate. This suggests that monetary policy in Ghana has a stronger influence on yields than in Kenya (Figure 3).

Figure 3: Monetary policy and yields on bonds.

Source: Illustration using data from Kenya National Bureau of Statistics and Ghana Statistical Service.

Notes: Yields are for government and corporate bonds traded on the Nairobi Securities Exchange (NSE) and Ghanaian Stock Exchange (GSE). The tenor for Kenya and Ghanaian bonds is 1–25 years and 1–7 years, respectively.

Movements in equity prices in an efficient market can be induced by monetary policy. More importantly, monetary policy decisions influence equity prices in so far as they change the expected returns on investment, thereby influencing investors' decisions on the stock market (Bernanke & Kuttner, 2005, Funke *et al.*, 2011). This has been exploited by monetary authorities to stabilize equity prices. In Figure 4, the cyclical component of Nairobi Stock Exchange All Share Index (NASI) prices for Kenya, and Stock Exchange-Composite Index for Ghana is counter-cyclical to monetary policy rate. However, monetary policy in Ghana has a stronger effect on equity price than in Kenya. This suggests that monetary policy can be used to deflate equity prices thereby safeguarding the integrity of the capital market in allocating long term investment.

Figure 4: Monetary policy and equity price stability

Source: Illustration using data from Kenya National Bureau of Statistics, Ghana Statistical Service, Ghana Stock Exchange (GSE), and Nairobi Securities Exchange (NSE).

Note: The cycle for equity price indices is the Nairobi All Share index (NASI) for Kenya, and Ghana Stock Exchange Composite index (GSE-CI) for Ghana.

Despite the fact that monetary policy in Kenya and Ghana is capable of enhancing price stability, there are differences in the responsiveness of equity, exchange rate, and yields on bonds, as well as the output growth outcomes in the economies. This calls for the analysis of, not only the response of monetary policy target variables, but also optimality of monetary policy actions.

Optimal Monetary Policy Stabilization of Output and Prices: Theory and Evidence

The debate on stabilizing output and prices using monetary policy follows two broad strands. The first strand asserts that monetary authority should not intervene in the economy. The second strand advocates for monetary policy intervention to stabilize prices and output. The proponents of non-interventionist monetary policy argue that a market economy with flexible prices is self-regulating. This enables economic agents to face prices that provide incentive to produce output that maximizes individual and social welfare. Hence, monetary policy intervention in the economy is distortionary (Rotemberg & Woodford, 1997; Svensson, 1997).

However, shocks, market power of agents, as well as information asymmetry among agents during transactions distort prices. Price distortions either misallocate or lead to under-utilization of an economy's resources. This results to actual output and inflation deviating from potential output and inflation target, respectively. Even in an efficient market, equilibrium prices may not be socially desirable (Svensson, 1997; Benigno, 2004). Consequently, monetary policy intervention is required to remove price distortions that impede the achievement of socially optimum output and prices. Even though Svensson (1997) and Benigno (2004) imply that monetary policy intervention is required to correct distortions in prices, they neither specify a set of prices to be targeted nor consider instability that may result from policy intervention. Yet, monetary policy actions influence commodity and asset prices, as well as incentive to take risks, and hence financial stability. In addition, they do not specify a framework of monetary policy intervention in contemporary economies. Monetary authorities either change monetary aggregates in tandem with output growth or change policy rates following some rule, with an objective of enhancing price stability (McCallum, 1999; Woodford, 2013; Were, 2014). Woodford (2013) and Were (2014) show that rule-based monetary policy is effective in achieving inflation and output objectives.

However, rule-based monetary policy frameworks may not consider agents' expectations and optimization decisions (Kydland & Prescott, 1977). As a result, monetary policy stabilization actions that follow some rule yield suboptimal welfare levels compared to stability achieved by a competitive market (King, 1997; Kydland & Prescott, 1977; Svensson, 1997). Nevertheless, a discretionary intervention achieves higher welfare than price or money targeting rule. This is because discretion affords monetary authority the flexibility to respond to unanticipated price and output changes, as well as dynamic optimization behaviour of economic agents. This is relevant for financial markets in which investors make decisions frequently to optimize

their portfolio holding. In addition, small open developing economies are susceptible to unpredictable capital flows and terms of trade changes, which affect asset and commodity prices, respectively. Hence, there is need for monetary authority to apply discretionary monetary policy to address price movement.

However, discretion results in, first, higher volatility in either prices or output. This is because discretion does not provide agents with rules and information that they can use to make current decisions. Consequently, agents adjust their decision as they get information, which affects stability of prices and output. Indeed, inconsistency in monetary policy action is a major cause of volatility in forward looking markets (Svensson, 1997; McCallum, 1999; Woodford, 2003). Secondly, discretion allows monetary authority to use its superior information compared to the public to pursue its main objective. King (1997) argues that monetary policy under discretion does not consider inflation expectations of the public when responding to output shocks. As a result, stabilizing output increases instability in inflation.

In as much as Svensson (1997), Woodford (1994, 2001), Benigno (2004), and McCallum (1999) advocate for monetary policy intervention in the economy, they specify output and inflation as target variables. However, stabilizing asset prices and enhancing financial stability to achieve growth has gained credence in developing and developed economies. Käfer (2014) and Caporale *et al.* (2018) argue that monetary policy in developing economies strive to stabilize inflation, output, and asset prices, while the focus on nominal exchange rate depends on openness and vulnerability of domestic prices to foreign shocks.

Empirical analysis of optimal monetary policy intervention in the economy evaluates social welfare outcomes of monetary policy action. The analyses focus on the approaches that achieve price stability. This approach is based on the fact that when prices are stabilized at a level that enables a socially acceptable allocation and production, they lead to maximization of social welfare. For example, Rogoff (1985), Rotemberg and Woodford (1997), Svensson (1997), and King (1997) analyse the effectiveness of commitment and discretion in maintaining inflation stability. The studies establish that commitment to an interest rate rule, when responding to high inflation, leads to inflation stability, although output growth rate deviates from the target. The interest rate rule also leads to higher instability in output despite inflation and interest rate being stable. Woodford (2003) focuses on a consistent interest rate adjustment by monetary authority in response to inflation changes. In this analysis, smooth adjustment of interest rate in the expected direction informs the expectation of the public, who optimize based on the information available. The study establishes that interest rate adjustment with inertia has a higher welfare compared to surprise adjustments. The inertial adjustment of interest rate provides information required for formation of expectation about future asset price, which reduce uncertainty in forward looking markets. Caporale *et al.* (2018) find that monetary authorities in

developing and emerging markets accord more weight to inflation compared to output and exchange rate. However, output and exchange rate are accorded more weight if inflation is either within the target or there are no threats to price stability.

Clarida *et al.* (2001), Benigno (2004), Corsetti and Pesenti (2005), and Divino (2009) extend the analysis to include exchange rate. In this way, they consider distortions in the domestic prices emanating from foreign economies. Their analytical solution of the social welfare function establishes that a consistent interest rate adjustment to stabilize inflation leads to output instability, because changes in interest rate affects exchange rate, which then causes a deviation of output from the socially desirable level. In this case, stabilizing inflation distorts the exchange rate, which reallocates resources in a manner that is socially undesirable. Recent studies by Fujiwara and Wang (2017) focusing on interaction between two monetary policy authorities find that there are welfare gains from optimal response to monetary policy inflation output and exchange rate.

Whereas monetary policy affects risk taking and asset prices in the financial market, empirical studies have focused more on stability of inflation, output, and nominal exchange rate. Woodford (2012) and Käfer (2014) find that imbalances in asset prices can be corrected by augmenting a monetary policy response function with a measure of financial stability. Indeed, Christiano *et al.* (2010) find that increasing interest rate over and above the level required to stabilize inflation corrects excess liquidity used to exacerbate distortions in asset prices. Proximate studies on Ghana, such as Kovanen (2011) and Bleaney *et al.* (2019), find that monetary policy has insignificant impact on interest rate; while Misati *et al.* (2011) and Were (2014) show that the impact of monetary policy on interest rate and equity prices is weak in Kenya.

There are few limitations to these analyses. Firstly, they do not consider financial asset prices, like bond and equity prices, when monetary policy is responding to price distortions. Equity and bond prices are one of the channels through which monetary policy stimuli is propagated in the real sector via the financial sector. Therefore, a monetary policy response function without equity and bond prices, which result from optimization decision of agents on the financial market, is deficient of important information (Käfer, 2014). More importantly, asset price movements affect aggregate demand by changing the net-worth and wealth of firms and households. Fluctuations in aggregate demand, as a result of asset price, induce instability in output.

Furthermore, asset price instability stifles growth by undermining the integrity of the financial sector to mobilize and distribute capital in the economy by distorting return on capital and balance sheets. Therefore, monetary authority eager to stabilize output and enhance growth, especially in developing economies, has

to include asset prices in its objective function. Secondly, equity and bond prices are a source of information that can be used by monetary authority to stabilize inflation (Bernanke & Gertler, 2000; Mishkin, 2001). Furthermore, monetary policy rates can inform pricing of risk on the yields of bonds, thereby influencing the term structure and the yield curve. Finally, in the general analytical solutions of Divino (2009), Clarida *et al.* (2001), Corsetti and Pesenti (2005), and Benigno (2004), social optimization problem with monetary policy intervention do not yield numerical results that can be compared.

Therefore, this paper tries to fill these gaps by analysing optimal monetary policy response to output and asset price volatility. The paper develops a dynamic stochastic general equilibrium model of an open economy with asset prices, and then calibrated to capture unique features of Kenyan and Ghanaian economies. Other parameters of the model are then estimated. A welfare analysis approach is used, because optimal intervention is more effectively evaluated by comparing welfare outcomes of alternative interventions. In addition, the welfare approach considers the optimization decision of the public, which is relevant for monetary policy. The social problem is also solved using dynamic programming numerical method, which allows a quantitative comparison.

Data source

The monetary policy stabilization actions influence interests and yields, which then affect portfolio decisions, and hence consumption and production. This influences prices and output in the direction desired by monetary authorities (Misati *et al.*, 2011; Misati & Nyamongo, 2012b). Underpinning price and output changes towards the monetary policy target is the change in the optimal decisions of agents. Households optimize their portfolio holding to maximize utility taking price as given, while firms adjust prices Calvo (1983) style to maximize profits. The Calvo (1983) style price adjustment captures price setting behaviour of firms in Kenya and Ghana. The economies have some firms with market power, while other firms take price as given and decide on the quantity to produce.

Conclusion

This paper focused on optimal monetary policy response to output and financial asset price instability. The results from dynamic stochastic general equilibrium (DSGE) model indicate that monetary policy responds more strongly to inflation, followed by interest rate, yields, equity prices, and finally output. In this regard, the response is consistent with main objective of stabilizing prices. Stable prices enable market mechanisms to allocate resources to efficiently produce goods and achieve growth, which is the ultimate monetary policy objective in developing

economies. Whereas price stabilization is the stated objective of monetary authorities in Kenya and Ghana, there are differences in the output and inflation outcomes. Namely, Kenya has higher weight on inflation, but has lower average inflation and higher output growth compared to Ghana, which employs inflation targeting framework. In addition, inflation and interest rate are higher in Ghana than Kenya. This implies that prioritizing price stability induces contractionary effect on growth in Ghana.

The effectiveness of monetary policy depends on the reaction of the public to a monetary policy stimulus. Hence, an optimal monetary policy maximizes social welfare by aligning social preferences with regards to output, asset prices, and inflation with monetary authority's preferences. The results indicate that, social welfare is maximized when monetary policy responds to inflation instability more strongly compared to output growth rate deviating from the desired target. Monetary policy should also respond to distortions in the equity and bond prices with less weight compared to the exchange rate. In addition, a consistent monetary intervention in the economy has lower social loss than discretionary intervention. This implies that, monetary policy actions that minimize uncertainty in the economy enhance liquidity management, optimal portfolio holding, and efficient investment, which are essential for growth. The emphasis on price stabilization objectives in inflation targeting regime in Ghana seem to be competitive with output objective.

However, under welfare criterion, stabilizing prices and output consistently is complementary, which increases welfare. Therefore, in developing economies, stabilizing prices, and output, considering the response of the public, increases the effectiveness of monetary policy and welfare. The implication of these results is that price and output stability outcomes are influenced by the manner in which monetary policy is used and not the monetary policy frameworks. In addition, considering all prices and output increases effectiveness of monetary policy as well as welfare. Therefore, the response of monetary policy to exchange rate, equity prices, bond prices, and output does not prejudice inflation stability.

Despite the fact that the DSGE model captures the effect of monetary policy in details and more accurate than competing frameworks such as general equilibrium and Vector Autoregression frameworks, the model did not include bond issuing behaviour of corporate and governments. The auction and pricing mechanism of bonds affect monetary policy and yields on the stock market. In addition, changes in yields affect equity prices. Therefore, a possible extension of this paper should include bond issuing equations for corporate and governments.

References

- Bailliu, J., C. Meh and Y. Zhang. 2015. "Macroprudential rules and monetary policy when financial frictions matter". *Economic Modelling*, 50: 148–61. <https://doi.org/10.1016/j.econmod.2015.06.012>
- Benigno, P. 2004. "Optimal monetary policy in a currency area". *Journal of International Economics*, 63(2): 293–320.
- Bernanke, B. and M. Gertler. 2000. "Monetary policy and asset price volatility". NBER Working Paper No. 7559. National Bureau of Economic Research, Cambridge, MA, February. DOI 10.3386/w7559
- Bernanke, B.S. and K.N. Kuttner. 2005. "What explains the stock market's reaction to federal reserve policy?" *The Journal of Finance*, 60(3): 1221–57.
- Bleaney, M., M. Atsuyoshi and M. Zakari. 2019. "Inflation targeting and monetary policy in Ghana". *Journal of African Economies*, 29(2): 121–45). DOI:10.1093/jae/ejz021
- Borio, C.E. and P.W. Lowe. 2002. "Asset prices, financial and monetary stability: Exploring the nexus". BIS Working Paper No. 114. Bank for International Settlements, Basel, Switzerland, July.
- Caporale, G.M., M.H. Helmi, A.N. Çatik, F.M. Ali and C. Akdeniz. 2018. "Monetary policy rules in emerging countries: Is there an augmented nonlinear Taylor rule?" *Economic Modelling*, 72: 306–19.
- Christiano, L., C.L. Ilut, R. Motto and M. Rostagno. 2010. "Monetary policy and stock market booms". NBER Working Paper No. 16402. National Bureau of Economic Research, Cambridge, MA, September. DOI 10.3386/w16402
- Clarida, R., J. Gali and M. Gertler. 2001. "Optimal monetary policy in open versus closed economies: An integrated approach". *The American Economic Review*, 91(2): 248–52.
- Corsetti, G. and P. Pesenti. 2005. "International dimensions of optimal monetary policy". *Journal of Monetary economics*, 52(2): 281–305.
- Di Bartolomeo, G., and F. Giuli. 2011. "Fiscal and monetary interaction under monetary policy uncertainty". *European Journal of political economy*, 27(2): 369–75.
- Divino, J.A. 2009. "Optimal monetary policy for a small open economy". *Economic Modelling*, 26(2): 352–58.
- Ennis, H., and T. Keister. 2008. "Understanding monetary policy implementation". *FRB Richmond Economic Quarterly*, 94(3): 235–63.
- Fujiwara, P., and J. Wang. 2017. "Optimal monetary policy in open economies revisited". *Journal of International Economics*, 108: 300–314.
- Gali, J. and T. Monacelli. 2005. "Monetary policy and exchange rate volatility in a small open economy". *The Review of Economic Studies*, 72(3): 707–34.
- Käfer, B. 2014. "The Taylor rule and financial stability — A literature review with application for the Eurozone". *Review of Economics*, 65(2): 159–92.
- Kholodilin, K., A. Montagnoli, O. Napolitano, and B. Siliverstovs. 2009. "Assessing the impact of the ECB's monetary policy on the stock markets: A sectoral view". *Economics Letters*, 105(3): 211–13.

- King, M. 1997. "Changes in UK monetary policy: Rules and discretion in practice". *Journal of Monetary Economics*, 39(1): 81–97.
- Kobayashi, T. 2004. "Monetary policy uncertainty and interest rate targeting". *Journal of Macroeconomics*, 26(4): 725–35.
- Koop, G., R. Leon-Gonzalez, and R.W. Strachan. 2009. "On the evolution of the monetary policy transmission mechanism". *Journal of Economic Dynamics and Control*, 33(4): 997–1017.
- Lester, B., A. Postlewaite and R. Wright. 2012. "Information, liquidity, asset prices, and monetary policy". *The Review of Economic Studies*, 79(3): 1209–38.
- Lucas, R.E. and N.L. Stokey. 1983. "Optimal fiscal and monetary policy in an economy without capital". *Journal of Monetary Economics*, 12(1): 55–93.
- McCallum, B. T. (1999). Issues in the design of monetary policy rules. *Handbook of Macroeconomics*, 1, 1483– 1530.
- Misati, R.N., E.M. Nyamongo and A.W. Kamau. 2011. "Interest rate pass-through in Kenya". *International Journal of Development Issues*, 10(2): 170–82.
- Misati, N. and M. Nyamongo. 2012. "Asset prices and monetary policy in Kenya". *Journal of Economic Studies*, 39(4): 451–68.
- Mishkin, F.S. 2001. "The transmission mechanism and the role of asset prices in monetary policy". NBER Working Paper No. 8617. National Bureau of Economic Research, Cambridge, MA, December. DOI 10.3386/w8617
- Rotemberg, J.J. and M. Woodford. 1997. An optimization-based econometric framework for the evaluation of monetary policy. *NBER Macroeconomics Annual*, 12: 297–346). <https://doi.org/10.1086/654340>
- Stulz, R. 1986. "Interest rates and monetary policy uncertainty". *Journal of Monetary Economics*, 17(3): 331–47.
- Svensson, L.E. 1997. "Optimal inflation targets, 'conservative' central banks, and linear inflation contracts". *The American Economic Review*, 87(1): 98–114.
- Vegh, C. A., & Vuletin, G. 2012. *Overcoming the fear of free falling: Monetary policy graduation in emerging markets* (No. w18175). National Bureau of Economic Research.
- Wamalwa, P. 2018. "Optimal monetary policy response to asset price and output volatility". Economic Research Southern Africa.
- Were, M. 2014. "Empirical analysis of monetary policy reaction function in an emerging African market economy". *International Journal of Economics and Business Research*, 8(3): 340–53.
- Woodford, M. 1994. "Monetary policy and price level determinacy in a cash-in-advance economy". *Economic Theory*, 4(3): 345–80.
- Woodford, M. 2001. "The Taylor rule and optimal monetary policy". *The American Economic Review*, 91(2): 232–37.
- Woodford, M. 2003. "Optimal interest-rate smoothing". *The Review of Economic Studies*, 70(4): 861–86.
- Woodford, M. 2012. "Inflation targeting and financial stability". NBER Working Paper No. 17967. National Bureau of Economic Research, Cambridge, MA, April. DOI 10.3386/w17967
- Woodford, M. 2013. *Forward Guidance by Inflation-Targeting Central Banks*. CEPR Discussion Paper No. DP9722. Centre for Economic Policy Research, London.



Mission

To strengthen local capacity for conducting independent, rigorous inquiry into the problems facing the management of economies in sub-Saharan Africa.

The mission rests on two basic premises: that development is more likely to occur where there is sustained sound management of the economy, and that such management is more likely to happen where there is an active, well-informed group of locally based professional economists to conduct policy-relevant research.

Bringing Rigour and Evidence to Economic Policy Making in Africa

- Improve quality.
- Ensure Sustainability.
- Expand influence.

www.aercafrica.org

Learn More



www.facebook.com/aercafrica



www.instagram.com/aercafrica_official/



twitter.com/aercafrica



www.linkedin.com/school/aercafrica/

Contact Us

African Economic Research Consortium
Consortium pour la Recherche Economique en Afrique
Middle East Bank Towers,
3rd Floor, Jakaya Kikwete Road
Nairobi 00200, Kenya
Tel: +254 (0) 20 273 4150
communications@ercafrica.org